



US006148219A

United States Patent [19]

Engelbrecht et al.

[11] Patent Number: 6,148,219

[45] Date of Patent: Nov. 14, 2000

[54] **POSITIONING SYSTEM FOR CDMA/PCS COMMUNICATIONS SYSTEM**[75] Inventors: **Lloyd Engelbrecht**, The Sea Ranch, Calif.; **Leonard Schuchman**, Potomac, Md.[73] Assignee: **ITT Manufacturing Enterprises, Inc.**, Wilmington, Del.[21] Appl. No.: **09/025,092**[22] Filed: **Feb. 17, 1998****Related U.S. Application Data**

[60] Provisional application No. 60/038,836, Feb. 18, 1997.

[51] Int. Cl.⁷ **H04Q 7/20**[52] U.S. Cl. **455/562, 455/561**[58] Field of Search **455/562, 456, 455/422, 457, 561**[56] **References Cited**

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Primary Examiner—Daniel S. Hunter*Assistant Examiner*—Myron K. Wyche*Attorney, Agent, or Firm*—Jim Zegeer**ABSTRACT**

Base station and system modifications to a digital cellular telephone system that measures location of a mobile station from its normal transmissions, and can forward the measured position to that station or some other authorized caller or service on the communication network. Range measurement is enabled without modification of mobile station equipment because of the synchronization between received pulse epochs and transmitted ones that are required for normal operation in digital telephony. Range measurement is made at a base station currently in contact with the mobile station by measuring the time interval from the start of its own transmitted pulse epoch to the start of a pulse epoch subsequently received from the mobile station, then dividing that time interval by twice the velocity of radio waves. Direction from the base station is determined, in a preferred embodiment, by use of a planar phase steered antenna array synchronized to pulse sequences from the mobile station.

10 Claims, 10 Drawing Sheets